

# THE EFFECT OF SALINE SOLUTIONS AND SEA-WATER ON *STEGOMYIA* *FASCIATA*

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*Stegomyia fasciata* is relatively intolerant of salt (NaCl). In some experiments carried out in 1915 it was found that the larvae died rapidly in 2 per cent. salt solution, that the gravid adult females were reluctant to lay their eggs on this medium, and that if, *faute de mieux*, they did so the eggs were killed and did not even harden and darken. Moreover, it was found that normal eggs of *S. fasciata* placed in salt solution of about the same strength (2·3 per cent.) failed to produce living larvae. From these and some previous observations (1914) it was thought that sea-water might be found to be of service in the campaign against this mosquito.

More recently these experiments have been repeated at Accra actually using sea-water. It was found that undiluted sea-water killed the larvae in a few hours (two to four), and that when diluted with tap-water 50 per cent. (equal to about 1·6 per cent. NaCl) or over was fatal within twenty-four hours. As regards the influence on the gravid females and the action on the eggs, the results were similar to those obtained with salt solution as is shown by the two following experiments.

EXPERIMENT I. 20th May, 1919. *Stegomyia fasciata*, two females and one male in a jar containing sea-water. Females fed this day.

22nd May. Male dead.

23rd " No eggs. Females fed at 10 a.m.

25th " 4 p.m.—many eggs on the water, all white.

5th June. No larvae have hatched.

EXPERIMENT II. 20th May, 1919. *Stegomyia fasciata*, one male and one female in a large jar containing sea-water in which stands a small beaker containing tap-water.

23rd May. Female fed.

24th " Male dead.

27th " Many eggs on the tap-water, a few only on the sea-water: the latter are white.

1st June. Many larvae in the beaker containing tap-water, none in the sea-water.

Sea-water, in fact, was found to act in a similar manner to a solution of common salt of equivalent strength.

An attempt was made to determine the highest percentage of salt that the larvae could tolerate. Such experiments are not easily devised because normally the larvae pupate after a few days, and it is therefore only possible to determine the percentages which prove fatal rapidly. Two series of experiments were carried out with the object of obtaining information on this point. In the one series larvae were used which were in the state of arrested development, to which reference has been made elsewhere (1915), and showed no inclination to pupate. Such larvae were placed in jars containing 100 c.c. or 50 c.c. of water to which each day 0.1 gm. of salt was added in a 10 per cent. solution; at the end of each experiment the amount of salt present in the medium was determined by titration. In four such experiments in which the strength of the saline medium was increased by 0.1 per cent. daily, the larvae did not survive more than 0.8, 0.9, 0.77, and 0.87 per cent. NaCl respectively. In four other experiments in which the strength of the saline medium was increased by 0.2 per cent. daily, they did not survive beyond 1.6, 1.8, 0.9, and 1.1 per cent. NaCl respectively. The results of these experiments were not quite satisfactory because in the control jars containing only tap-water some of the larvae died, showing that either the larvae in this state were delicate or that they were suffering from the lack of suitable or sufficient food.

It was thought, therefore, that a better practical test of the amount of salt tolerable to the larvae of *S. fasciata* would be obtained by starting a culture of these insects in a medium containing a low percentage of salt, allowing it to concentrate naturally by evaporation, and noting the point at which the larvae died. Such experiments it was thought would also show if the larvae were able to become habituated to high degrees of salinity.

An experiment was, therefore, started with a natural medium, rich in organic material, in a large jar on the sides of which were very many ripe eggs of *S. fasciata*. Sufficient common salt had been added to the medium to bring the percentage of NaCl up to 1.1. The jar, covered only by a piece of gauze, was then placed on the laboratory bench and allowed to concentrate gradually by natural evaporation. The larvae which hatched from the eggs developed

rapidly at first, then more slowly, and after about a fortnight appeared to be dying off. On the nineteenth day, when it was clear that they were rapidly diminishing in number, a small quantity of the medium was withdrawn for analysis. It was found to contain 1.3 per cent. NaCl. From this time onwards the larvae steadily dwindled, the last individual dying on the thirty-sixth day of the experiment, when the salinity of the medium was found to be 1.45 per cent. NaCl. During the experiment only a very few of the larvae pupated, and all that did so, excepting the first (which pupated on the ninth day, when the salinity was estimated to be 1.2 per cent.), died in the act. A second experiment on the same lines may be summarised as follows:—

- 1st Day. Salinity of medium equals 1.1 per cent. NaCl. Multitudes of little larvae which have just hatched.  
 8th „ Larvae fewer and not growing much.  
 16th „ Very few surviving larvae. No pupae yet.  
 18th „ Only two surviving larvae.  
 20th „ Last larva dead. Salinity of the medium found to be 1.38 per cent. NaCl. No pupae have appeared.

The four experiments of this sort (see table) that were carried out showed that the percentages of salt in the media at the times of the deaths of the last larvae were 1.45, 1.38, 1.45, and 1.45,

Number of days for which the experiment lasted	Percentage of NaCl in the medium at the beginning of the experiment	Percentage of NaCl in the medium at the end of the experiment, namely, when the last larva died	Number of pupae
36	1.1	1.45	1, and a few which died.
20	1.1	1.38	None.
24	1.0	1.45	None.
...	...	1.45	

respectively. The larvae had, of course, begun to die off some considerable time before this concentration was reached. Pupation was very seldom attempted, and was usually fatal. The experiments furnished no evidence that the larvae could be habituated to such degrees of salinity.

The inference from these experiments would appear to be that a 1.0 to 1.4 per cent. solution of common salt, or an equivalent strength of sea-water, would effectually prevent the larvae of this mosquito from developing to the adult stage. It would seem probable that sea-water, if used for such purposes as flushing drains and gutters, scouring market-places, etc., would kill both the larvae and the eggs of *S. fasciata*, and that even if puddles were left the adult females would be reluctant to deposit their eggs on them, but that if they did so the eggs would be killed immediately.

#### REFERENCES

- MACFIE, J. W. S. (1914 and 1915). *Bull. Ent. Res.*, IV, p. 339, and VI, p. 225.